whose conductivity type is the same as that of the silicon substrate.

Further, in the above examples, the grooves have vertical or substantially vertical walls. However, the present invention is not limited to this. For example, a wedge-shaped groove **403** whose surface is inclined by an angle θ with respect to the surface of the silicon substrate may be formed as shown in FIGS. **44A** and **44B**. In this case, the thickness of an insulating film **405** is greater than $(a \times \cot(\theta/2))/2$ where a denotes the width of the opening of the groove. Further, a groove having tapered walls and a flat bottom may also be used.

Further, as shown in FIG. **45A**, an insulating film **502** formed on a substrate **501** need not be etched to expose the surface of the substrate **501**. An insulating film **502'** may be left on the surface of the substrate **501** as shown in FIG. **45B**. The insulating film **502'** may be used as a gate film or an insulating interlayer, or a part thereof.

Further, as shown in FIG. **46A**, grooves **503** are formed in the substrate **501** using a mask **504**, and an insulating film **502** is then deposited on the mask **504**. The insulating film **502** may be etched to leave the mask **504** on the substrate **501** (FIG. **46B**).

What is claimed is:

1. A method for manufacturing a semiconductor device, comprising the steps of:

(a) forming at least one groove which has vertical or substantially vertical wall in a desired portion of a semiconductor substrate;

(b) selectively doping an impurity, whose conductivity type is opposite to that of said semiconductor substrate, in said at least one groove to form a wiring layer; and

(c) depositing an insulating material to cover an entire surface of said semiconductor substrate including said at least one groove to a thickness greater than half the width of the shortest side of the opening of said at least one groove, and forming field region by etching the insulating film of said insulating material to leave said insulating material in said at least one groove.

2. The method according to claim **1**, wherein said impurity in step (b) is ion-implanted in the bottom of said at least one groove to form a wiring layer.

3. The method according to claim **1**, wherein after said at least one groove is formed in said semiconductor substrate and said impurity is ion-implanted, and before said insulating material is deposited, an oxide film or a nitride film which does not block said at least one groove is grown by oxidizing or nitrifying the entire surface of said semiconductor substrate or at least part of said at least one groove.

4. The method according to claim **1**, wherein after said at least one groove is formed in said semiconductor substrate and before said impurity is ion-implanted, an oxide film or a nitride film which does not block said at least one groove is grown by oxidizing or nitrifying the entire surface of said semiconductor substrate or at least part of said at least one groove.

5. The method according to claim **1**, wherein after said insulating film is deposited, a low-melting point material is doped on an entire surface layer or part of a surface layer of said insulating film and is annealed to melt a doped layer of said insulating film, and said insulating film is etched.

6. The method according to claim **1**, wherein after said insulating material is deposited, a low-melting point insulating film is deposited on an entire surface or part of a surface of said insulating film and is melted, and said low-melting point insulating film and said insulating film are etched.

7. The method according to claim **1**, wherein the forming step includes forming at least a second groove in the semiconductor substrate and an impurity whose conductivity type is the same as the conductivity type of said semiconductor substrate is doped in said second groove to form a channel stopper, and said impurity whose conductivity type is opposite to the conductivity type of said semiconductor substrate is doped in said at least one groove to form a wiring layer.

8. The method according to claim **7**, wherein immediately after said impurity whose conductivity type is opposite to the conductivity type of said semiconductor substrate is doped in said at least one groove, said impurity whose conductivity type is the same as the conductivity type of said semiconductor substrate is doped in the second groove.

9. The method according to claim **1**, wherein one part of said at least one groove is shallower than a diffusion depth of said impurity region formed in said semiconductor substrate, and the other part of said at least one groove is deeper than the diffusion depth of said impurity region, whereby a wiring layer which has a conductivity type opposite to the conductivity type of said semiconductor substrate and which is formed under said one part of said at least one groove is electrically connected to a region of said impurity region, which has the same conductivity type as the conductivity type of said semiconductor substrate.

10. A method for manufacturing a semiconductor device, comprising the steps of:

forming at least one groove which has vertical or substantially vertical walls in a desired portion of a semiconductor substrate;

selectively doping an impurity, whose conductivity type is opposite to said semiconductor substrate, in said at least one groove to form a wiring layer;

depositing an insulating material on said semiconductor substrate including said at least one groove to a thickness greater than half of the width of the shortest said of the opening of said at least one groove;

after forming a mask on at least one portion of the insulating film which includes part of the insulating film of said insulating material formed in and on said at least one groove and another part of said insulating film which corresponds to a prospective field region, etching said insulating film to leave said insulating material in said at least one groove said so as to form field regions in and out of said at least one groove.

11. The method according to claim **10**, wherein after said at least one groove is formed in said semiconductor substrate, after or before impurity is ion-implanted and before said insulating material is deposited, an oxide film or a nitride film which does not block said at least one groove is grown by oxidizing or nitrifying an entire surface of said semiconductor substrate or at least part of said at least one groove.

12. The method according to claim **10**, wherein after said insulating film is deposited, a low-melting point material is doped on an entire surface layer or part of a surface layer of said insulating film and is annealed to melt a doped layer of said insulating film, and said insulating film is etched after a mask is formed thereon.